Evolution of the Venus Fly Trap

(Ivan Snyder, 110 Meyer Court, Hermosa Beach, CA 90254)

In this article I will demonstrate how I believe the Venus Fly Trap evolved to its present form from a noncarnivorous plant.

There are plants which are capable of capturing insects though they are not carnivorous, and they do so unintentionally. These plants have sticky gland-tipped hairs which they use to discourage plant-eating animals. Insects alight on them and become ensnared by the adhesive substance. Plants with glandular hairs are common in a large number of plant families. An example I have grown and observed capture very small insects is *Mimulus pilosus,* a member of the family Scrophulariaceae. Many plants of this family are glandular pubescent, and some are quite viscid. The glandular secretion of these plants is chemically similar to the sticky trapping mucilage of carnivorous plants.

Probably the first truly carnivorous plant evolved from a glandular pubescent bog inhabiting plant by one simple change. A mutation occurred which relocated a gene that controlled the manufacture of protein dissolving enzyme to the glandular hairs. This gene was originally expressed in the seed, where the embryonic plant used the enzyme to break down food sources stored in the endosperm. With this adaption the plant can digest as well as capture insects. Insects are trapped in the sticky mucilage and their soft tissues are dissolved by enzyme and flow out over the leaf surface where they are absorbed by the same principle as foliar feeding. This gives the plant a greater advantage in a bog environment where available nutrients are low. With time, following generations develop stickier secretions and produce digestive substances better upon the capture of insects. Separate glands which produce enzyme only, resting on the leaf surface, develop from the mucilage glands. This first carnivorous ancestor of the Venus Fly Trap (fig. #1) may have looked similar to a butterwort. The families *Droseraceae* and *Lentibulariaceae* must have had a parallel evolution in their beginnings.

The next evolutionary step toward the Venus Fly Trap is the plant's ability to bend its leaves and cup them around captured prey. This mechanism was adapted from the plant's ability to bend toward light. Instead of bending in response to light, the leaves can also bend with the detection of protein. At this same time, the plant evolves tentacles which developed from modification of the glandular hairs. The glandular hairs became larger in size and acquired the bending ability in response to tactile stimulation. With tentacles and curling leaves the plant has now become a sundew, the direct ancestor of the Venus Fly Trap. (fig. #2)

The next development is bending ability of the sundew leaf centered along the leaf midrib. This was beneficial for capturing larger prey, and following generations perpetuated this trait and evolved faster closing leaves (fig. #3). The traps became quick enough so that the plant no longer needed tentacles. But with modification the tentacles became trigger hairs on the inner surface of each lobe, and tentacles on the outer edge developed into the trap cilia to bar the escape of insects. The glands which were atop the tentacles now rest on the inner surface of the trap, no longer making sticky mucilage to trap, but still produce digestive fluid when insects are trapped. With these adaptions the once sundew can now be recognized as a Venus Fly Trap (fig. #4), though there are still more devices this plant can use.

Now that the trap is cleared of tentacles, a new advantageous change can take place. Another translocational mutation occurred which gave some of the glands in the trap the ability to produce nectar. This trait was originally present in

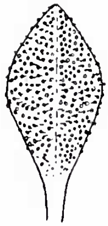

fig. #1

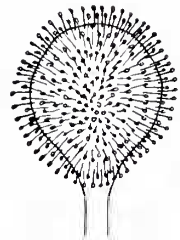

fig. #2

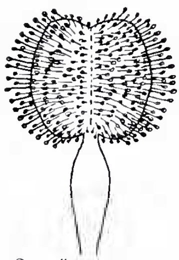

fig. #3

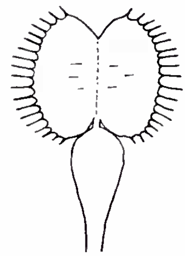

fig. #4

Drawings by Ivan Snyder.

the nectaries within the flower parts. With this desirable genetic accident the plant became able to attract insects. An additional attractant which developed is more pigment in the trap. The trap entices insects by mimicking a flower with bright color and sweet nectar.

Literature Cited

Adrian Sack (1979) Carnivorous Plants pp. 18-20.

Ching, T.M. Metabolism of Germinating Seeds chap. 2 pp. 103-218. In: Seed Biology. T.T. Kozlowski, ed. Vol. 2. New York, Academic Press. 1972.

VCPS Show (from p. 101)

ing like a carnivorous bonsai, with small specimens of *Sarracenia, Pinguicula, Drosera* and *Dionaea.*

THE SALE TABLE

After seeing how easy it was to divide *Nepenthes* and *Sarracenia,* a surprising number of people were prepared to try to grow some species of these. The sale table was simply swamped after each demonstration. This could point to the fact that for all the talking and reading about plants, the "hands-on" approach is the one that really gets results.